MANUFACTURING BPM WITH APRISO

A White paper written by Bruce Silver
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The Power of Process

Over the past decade, a key lesson learned on the shop floor has been increasingly applied to the office environment: it all comes down to process. Maintaining quality, reducing costs, meeting customer commitments, improving agility, and enforcing compliance with policies and regulations all demand careful documentation, monitoring, and optimization of end-to-end manufacturing processes. Meanwhile in the office setting, business process management (BPM) has brought about a new way to look at the business, not as a collection of independent functional units and systems, but as end-to-end flows that cut across those traditionally stovepiped boundaries. It stands to reason therefore, that BPM applies equally well to manufacturing.

BPM begins with modeling the processes, mapping the flows to show all possible paths from beginning to end, analyzing them, and measuring business performance from that end-to-end perspective. Once BPM gains a foothold on existing processes, it then serves as a foundation for and accelerates business process improvement. But realizing the benefits of BPM requires more than just mapping the processes. It needs software technology that actually executes the process models: coordinating and synchronizing resources and materials, routing tasks to people, machines, and backend business systems, integrating data across the stovepipes, executing business rules, responding to events, and monitoring process performance in real time.

Today, BPM technology has evolved to provide all of this in an integrated platform, and has become a critical enabler of business innovation and optimization at the corporate level. Yet despite its success in the office environment, this technology remains rare on the manufacturing shop floor, where BPM remains largely synonymous with simple process modeling. Most Manufacturing Execution Systems (MES), for example, just document the routings, recipes, and other types of processes involved in manufacturing production operations. They don’t have the ability to actually execute them, monitor them from an end-to-end process perspective or take direct remedial action from a central process management console. Moreover, most MES systems are focused on only production, or even more narrowly on specific forms of production automation, versus across operations to include activities like quality, maintenance and material logistics. True BPM therefore becomes a natural fit to enforce process execution and control user interactions across business processes.

Apriso does, and is the first manufacturing executions vendor to apply both the management principles and technology of BPM to manufacturing operations. FlexNet takes it a step further, going beyond a traditional MES by providing a native BPM platform for global operations execution – a full-featured Operations Execution System, or OES as the company calls it. Apriso has layered on top of BPM a system sufficiently wide in scope to manage and execute all global manufacturing operations, including the necessary process and data modeling, workflow automation (human and machine), business activity monitoring (BAM), and global management of process deployment and governance.
This paper explains what BPM is, why you need it within a manufacturing operations environment, what it brings to an OES and how Apriso’s FlexNet is different from competitors who are beginning to talk the BPM talk without delivering the goods.

What Is BPM?

**BPM as a Management Discipline**

BPM as a management discipline is a new way of conceptualizing the business. It means viewing the business from an end-to-end process perspective, cutting across the various business systems, functions, and organizations involved in the process. The process model or map is a unified end-to-end description of process activities and flows from beginning to end. It describes the flow logic explicitly in a graphical manner, from which it can be readily understood, analyzed, and possibly improved, even though the technical implementation of that logic may be hidden inside disparate business applications, in programmable logic controllers and machines, or worse, in the minds of key personnel.

BPM as a discipline also advocates an end-to-end perspective in measuring business performance. The process is only as good as its weakest link, so metrics of time, cost, and quality must be based on end-to-end measures. Those are the measures your customers and suppliers judge you by, and the ones most directly affecting your company’s financial bottom line. BPM technologies provide simple mechanisms to monitor these metrics in dashboards, drill down to root cause analysis, and remediate problems in real time.

Lastly, BPM as a management discipline anticipates change. In fact, the major reason for modeling the process – extracting the flow logic hidden inside the applications, machines, and human participants – is to be able to change it more easily, and to understand the impact of those changes.

*Apriso is unique in the Operations Execution arena by incorporating BPM as a management discipline.*

**BPM as a Technology Platform**

But BPM is more than just a management discipline. It is also a software technology. The technology of BPM makes the process model more than just a “plan.” It is a template that defines the possible paths allowed from beginning to end, enforced by an automation engine that executes each step in the proper sequence. That software automates the flow as described by the process model, routing and tracking human tasks, enforcing business rules, querying and updating various backend business systems.

Key principles of BPM as a management discipline, such as an integrated end-to-end view, building for change, and continuous performance improvement, are reflected in BPM as a technology platform. A true BPM platform requires a unified process design environment able to orchestrate the actions of all the disparate user roles, business systems, and other...
actors in the end-to-end process. That in turn requires a unified data model applicable end-to-end as well. Building for change means that it must be easy to modify the executable process design and quickly deploy it as a new version. In some cases, adaptive processes can accommodate variation and change even without versioning and redeployment.

The BPM technology platform contains four key components:

1. **Modeling component** – A non-analysis and design time component for non-IT users to document current (as-is) processes, describe proposed to-be processes, and project expected performance improvement using simulation analysis.

2. **Design component** – Used by IT to add implementation detail to the model, if needed, allowing it to be executed on a process engine.

3. **Workflow engine and task manager** – The engine controls the sequence of process steps, both human and automated, as dictated by the rules encapsulated in the design. It presents assigned tasks to users, and maintains an audit trail of all steps in the process. While the process is running, the engine logs snapshots of runtime data used for performance analysis.

4. **Monitoring and remediation, also called business activity monitoring, or BAM** – Aggregation of key performance indicator (KPI) data logged by the process engine (and possibly directly from the systems themselves), with display in user-configurable dashboards of charts and tables, linked for drilldown root cause analysis. Unlike standalone BAM, BAM integrated with BPM is able to trace problems to specific steps in the process and provide a mechanism for remediation from a central management console.

Figure 1. BPM as a technology platform combines process modeling with executable design, an automation engine, workflow task management, an integration framework, and BAM.

Figure 1 illustrates the components of a BPM platform. The boundaries between modeling – a “business” function – and executable design – traditionally an IT function – are blurring, as BPM technologies make process design functions increasingly available to non-IT users.
While modeling focuses on the activity flow, or "orchestration," the complete executable design must also specify task assignments and user interface, enforcement of policies and rules, and interconnection of both backend systems (ERP, PLM, etc.) and controllable machinery through the integration layer, today mostly based on service-oriented architecture (SOA). The ability to define all of these aspects of the process within a single unified design environment, leveraging a unified data model, separates BPM from older styles of less agile software technology. Similarly, the BPM runtime, which includes an orchestration engine, human task management, integration middleware and adapters, and BAM, also provides a unified environment spanning all aspects of the automated process.

The technology of BPM is not just for IT. While IT people use the BPM technologies to do the "heavy lifting" of process design, industrial engineers, process control engineers, warehouse management specialists and other "process engineers" that own business areas in a plant are the end users of both the BPM tools and the run-time process solutions that result.

*While a number of vendors provide such a platform as a standalone BPM Suite, it can also be embedded within a vertical solution such as an Operations Execution System, which is what Apriso has done.*

**BPM as an Implementation Style**

A third aspect of BPM is worth mentioning: business empowerment. The tools employed in the BPM technology platform are intended to empower non-IT users and eliminate code without sacrificing power and flexibility in the automated process solution. Process modeling and even much of executable design should be business functions not dependent on an IT developer. While IT rightfully retains a critical role in the process implementation lifecycle - for system integration, advanced customization, testing and deployment - many functions requiring developers in traditional implementation styles can be performed with relatively little IT involvement by using BPM. This is an important contributor to BPM’s agility, particularly when IT resources are in short supply.

*Again, Apriso stands out by bringing code-free process configuration into the world of manufacturing.*

**Benefits of BPM**

BPM has brought five distinct classes of benefits to the office workplace, all relevant to manufacturing operations:

1. **Innovation through analysis**

   By surfacing buried process logic in a diagram, process modeling creates a shared visual language for documenting the process end-to-end, analyzing its strengths and weaknesses, and proposing various to-be improvements before committing to implementation. Because of the stovepiped nature of single-function organizations and systems, the BPM process model frequently provides the only end-to-end description of the process in existence.

2. **Efficiency through automation**

   By automating the flow of tasks, tracking deadlines, and managing task priorities, BPM makes processes run faster with less wasted time, more efficient utilization of resources, and greater coordination end to end. This lowers operational costs, while increasing customer satisfaction.
3. Standardization and compliance

On the shop floor, routings and recipes just represent processes “as planned.” By making plans executable, BPM ensures they represent the processes “as executed.” Standard operating procedures and compliance with regulations are enforced. Policies can be maintained as business rules and reused in multiple processes. Moreover, because process models can be shared through a repository, a best practice in one plant can be replicated throughout the enterprise.

4. Agility

BPM allows new processes to be implemented more quickly, and allows existing processes to be tweaked and customized more easily. One reason is that the activity flow logic has been made explicit in the process model, not buried inside application code. Once externalized, process logic is easy to customize and easy to change, usually without any code. BPM provides customization through configuration – without custom code – so solutions are upgradeable, transportable, and supportable long-term. Modern SOA middleware provides a common way to integrate disparate backend systems, with BPM as the central controlling intelligence and tracking mechanism. The combination of BPM and SOA encourages reuse of IT assets, including legacy assets, in multiple processes throughout the enterprise. All of these factors enhance agility.

5. Performance visibility and continuous improvement

BPM allows you to monitor performance as it really counts – from an end-to-end perspective – and gives you a platform for remedial action in real time. BPM’s BAM component lets you define rules that continuously monitor process KPIs and alert users when values begin to go off track. These alerts don’t just point to the source of trouble, but let you take corrective action directly from the management console. That’s because BPM is more than a plan. It’s the underlying framework of end-to-end process control. Metrics collected by BAM can also be fed back to the modeling/analysis tool to further optimize process performance, critical to BPM’s philosophy of continuous improvement.

BPM Applied to OES

The previous discussion applies to BPM as it is usually applied – in the back office or front office, but rarely on the shop or warehouse floor. Nevertheless, the opportunities to apply those features and benefits to manufacturing operations are numerous.

In a manufacturing enterprise, the three key value chain functions of planning, designing, and building are typically supported by distinct IT systems (Figure 2): Enterprise Resource Planning (ERP) supports transactions related to product planning, sourcing, sales, and other business matters. Product Lifecycle Management (PLM) supports product definition and structure. Manufacturing Execution Systems (MES) support factory production on the shop floor. A more complete view of manufacturing operations, such as that taken by Apriso FlexNet, extends MES with support for labor, quality, warehouse and maintenance operations. This enlarged scope may be called an Operations Execution System (OES), part of a larger discipline of Manufacturing Operations Management (MOM).
Gartner's term *Manufacturing Process Management* (MPM - Figure 2) reflects one aspect of applying BPM to the manufacturing enterprise, improving the interfaces and workflows linking ERP, PLM and OES/MOM. Another aspect is adopting the principles of BPM to processes *within* each system, such as OES, to make it more agile and flexible, more efficient, and measurable end to end. MPM is not a standalone technology like ERP, PLM or OES, but a capability that could be integrated into any of those systems to improve performance within the manufacturing enterprise. Many PLM, ERP, and MES vendors have added process modeling to their tools in order to claim the mantle of MPM. Apriso FlexNet stands out by including a true BPM platform – not just modeling but process automation and BAM as well – within its OES.

**Examples of Manufacturing Business Processes**

Manufacturing operations include many types of processes involving a wide range of departments and roles. Examples include:

- **Production processes** – Process routings and recipes; weighing, mixing, processing and packaging; standard operating procedures; assembly work instructions.
- **Warehouse processes** – Material receiving procedures, material replenishment of production lines and other warehouse and inventory management processes.
- **Quality processes** – At-line sampling and inspection control, containment procedures, Six Sigma, ISO 9000, corrective and preventive actions, change management with regulatory compliance.
- **Maintenance processes** – Maintenance procedures and work instructions, such as periodic device control and calibration.
- **IT processes** – Information integration workflows, such as reporting production (good quantity, scrap quantity, machine time) against order to ERP.
- **Supply chain processes** – Orchestration of enterprise manufacturing processes, including collaboration with departments and trading partners.
- **Lean processes** – Value Stream Mapping, best practices standardization, and other Lean initiatives to reduce waste.
- **Kanban processes** – Manages supply replenishment from the point of consumption in production to sourcing in the supply chain.
End-to-End Manufacturing Processes

It is vital to understand that “process” in the full context of manufacturing operations means more than just production routings and recipes. Those are just the production processes. A platform for true operations execution has to include quality, maintenance, labor, and the other execution functions. BPM emphasizes viewing processes end-to-end, not as disconnected single-function procedures. End-to-end processes are inherently cross-functional, involving other departments and actors within the enterprise. Bringing all of these activities under the umbrella of a single BPM framework is important to optimizing operational performance.

Figure 3. Routings or “plans” represent just the production aspects of the end-to-end process. Source: Apriso

End-to-end processes are beyond the scope of most manufacturing execution systems. For example, in MES a process typically just means a routing or recipe for production activities. Routings (Figure 3) interconnect pieces of equipment supporting the process as materials are moved from one location to another and either produced or assembled. Routings encapsulate the work instructions, setup, calibrations and materials required to do the job, and may include additional tasks like QA inspections.

Once a routing is complete it will dictate the next work center the material (Lot, Serial, Work Order) needs to move to. Unfortunately, the realities of the shop floor are not only more complex then a typical routing can support, but are constantly changing as well. Routings are focused on the primary piece of equipment to be used at the time of the job. They do not consider skills required and the subtleties required to move material around the shop floor.

Figure 4. End-to-end operations processes involve multiple departments and systems. Source: Apriso
The actual end-to-end process involves more than just the routing. Production activities are part of the process, but they execute in a process context that also involves logistics, materials handling, maintenance, and quality. BPM looks at the complete process and all the stakeholders. Production is just one “swimlane” in the end-to-end model (Figure 4). In BPM the model defines how actions are executed and decisions are made, and where responsibility is handed off between functions. Such a model also provides a more flexible and accurate description of equipment setup and materials acquisition than a typical MES routing. With a routing these tasks are tied to the particular machine, but in reality they are performed by different personnel using different equipment. Thus the actual production process is far more than machine setup, but must coordinate a range of resources, expertise, and demands across the plant.

To be a world-class manufacturer, you need a system that truly represents how operations are executed and allows you to visualize, measure and improve your processes end to end. You need a system based on BPM.

**Unified Design and Runtime Environments**

Applying BPM to operations execution requires more than just tools for modeling cross-functional activity flows. It also demands a unified environment for defining all aspects of process execution – activity flow, user interface, policies and rules, integration, BAM, staging and deployment – as well as a unified runtime environment for all of these aspects as well.

**Figure 5. Apriso’s unified platform vs typical OES component approach. Source: Apriso**

Apriso FlexNet (Figure 5, left) provides such an environment. It features a unified data model, interface, and programming model for all functions, none of which are the norm in other MES/OES offerings today. For example, most competitors define production routings in the MES, but specify machine control and SCADA in a separate application, quality workflows in a third system, and so on. Often these systems were originally designed as standalone components, and have different architectures, data models, user interfaces, and programming models. While vendors may provide some loose integration of these applications under a common “branding,” such an architecture cannot achieve the objectives of true BPM.
Apriso’s Manufacturing BPM Solution

Overview

Apriso FlexNet is not a general-purpose BPM platform, but a full-featured OES solution that is built natively on a BPM architecture. The BPM platform and tools are an embedded part of the solution.

FlexNet rests on three architectural pillars the company refers to as “BUS,” which stands for BPM, Unified Data Model, and SOA. BUS describes the synergy of combining a BPM solution with pre-authored business processes that work on top of a unified, normalized, and OLAP-friendly data model, which can integrate with any number of standard SOA business components. In FlexNet, these process, data, and SOA components are obviously targeted to manufacturing operations execution.

FlexNet’s BPM helps control and automate resources – which can be machines, employees, tooling, containers, or materials – while respecting the complexities of product-resource-process dependencies. This is a key difference between a BPM-enabled manufacturing solution and a general purpose BPM S.

FlexNet can integrate manufacturing execution with ERP but runs independent of the ERP system. It also can run with no ERP at all. For example, in aerospace, i2 (just acquired by JDA) or other “planning systems” can feed daily released orders to FlexNet, which executes them to completion, including the handling of repair, engineering changes, etc., on live production orders and in-line process changes.

Conceptually the FlexNet platform contains three layers (Figure 6).

- The bottom layer is BPM, or what Apriso calls its Adaptive Execution Platform. This layer includes the BPM process authoring tool or “design-time” called Process Builder, a unified database and data model, a human workflow and process coordination runtime, and an integration broker to achieve enterprise application integration and intelligent device or machine integration. Although an exhaustive list is not shown in the figure, the platform also includes components to handle security, auditing, reporting, archiving, localization and other shared platform services.

- The middle layer is the OES suite, integrated applications providing production, quality, warehouse, maintenance, and labor execution applications. These applications have been “authored” using Process Builder and consume the underlying business component logic and data. This is why the company positions its applications as “native” BPM.

- The top layer, called the Global Manufacturing Suite, supports BPM at the enterprise level. Global Process Manager controls governance, staging and deployment of processes across the enterprise. This is a unique Apriso value-add to the general BPM space in that few others have anticipated the need to share processes across locations or “nodes.” Global Performance Manager is the BAM component of the suite and is used to monitor not just low-level process steps but KPIs across all operations, whether part of the OES domain or aggregated from other data sources within the enterprise. Finally, Global Production Manager allows the FlexNet platform to extend business process flows beyond the enterprise firewall. A number of Apriso customers use FlexNet to link supply-chain and B2B processes outside the firewall belonging to their trading partners or supply network, with manufacturing processes within their plants and OES.
Process Builder

Process Builder is the modeling/design component of Apriso FlexNet, supporting both process engineers and IT. Unlike a general-purpose BPM suite, it is “manufacturing-aware,” providing prebuilt components and flows needed in OES. For example, it allows for attachment of resources, visual work instructions, material components, documents, quality characteristics, and specification to process activities (Figure 7). But unlike its MES competitors, Apriso goes beyond simple linear production routings to provide a complete process design tool, following the key tenets of BPM:

- Complex and adaptive end-to-end flows
- User interface design without code
- Integration of people, material, machines, tools with process logic
- Integrated governance, validation, testing, and deployment
Complex and Adaptive Flows

In FlexNet, process actions can be triggered from virtually any source: human action, machine, web service, or inbound XML message. Most MES competitors only model linear production routings, but Apriso can model real-world end-to-end activity flows, offering multiple options for conditional branching, parallel splits, and merging. Historically, applications like PLM and ERP have implemented an oversimplified static view of process routings (also called process plans). But in the BPM world, the routing is where the rubber meets the road in production, where system behavior is determined by the precise state of the process – the process step, the state or context of the user or machine. Thus with BPM, routings or process plans mean much more than they used to in the PLM/ERP world. Moreover, the end-to-end process goes beyond routings to include activities in other parts of the plant, and Apriso’s Process Builder accommodates this as well.

In BPM, process definitions must also adapt to exceptions and change. For example, a released process might need to be modified quickly to handle an active production order. Because BPM externalizes the flow logic in a diagram, you can use Process Builder to add a new step such as in-line rework to a released process, test and deploy it as a new version, and move in-process items from the open work order to the new deployed version in less than an hour. In highly dynamic environments demanding even faster adaptation, Process Builder allows new “sub-operations” to be selected from a palette of previously built and released alternatives, with automatic transfer of affected serial numbers or production lots to the dynamic child process.
UI Design

One of the biggest barriers to agility in most applications is definition and customization of task user interfaces. FlexNet Process Builder follows the BPM paradigm of integrating UI design directly within the tool, and giving non-IT users the ability to configure screens that support user input, system queries and updates, and machine control (Figure 8). Form fields can be linked by point-and-click to a wide choice of input sources, and the resulting UI can be rendered on Personal Digital Assistants (PDAs) or small mobile devices.

Figure 8. Task user interfaces can be designed by non-developers. Source: Apriso

Figure 9. Database queries can be executed automatically by the process engine. Source: Apriso

Integration

Beyond human tasks, BPM must integrate directly with databases, enterprise applications, and plant machinery, in a unified fashion. Process Builder does this. Process steps can
execute SQL queries (Figure 9), for example, to populate user screens or govern flow logic. Apriso also has pioneered the integration of backend business systems with OES. For example, it integrates directly with ERP from SAP, Oracle, interBiz PRMS, SSA BPCS, and others to import order details or execute ERP transactions. Process Builder also allows the executable process to directly control machinery on the shop floor.

Moreover, BPM is used not just at the plant level, but also to facilitate collaboration with customers and supply chain partners. While Apriso supports popular integration middleware (e.g., IBM WebSphere, Microsoft BizTalk, and SAP XI) for B2B message delivery, the process is controlled by BPM, not the middleware. That is because process success depends on more than reliable message passing, and is equally affected by the actions of people, machinery, and other asynchronous events. Traditionally, integration technology has focused on individual short-running transactions, not the end-to-end process where the real business logic resides and where real business performance is determined. BPM treats the end-to-end process as an integrated system, and is better able to automate B2B interactions.

Global Deployment and Process Management Governance

Process models – templates for actual process execution – are mission-critical and must be carefully governed at the enterprise level. That includes testing and staging from development to test, pilot, and production servers (Figure 10). In today’s manufacturing enterprise, you need native BPM tools to support model sharing and lifecycle management not only across development, QA, and production, but across various plant locations and centralized centers of excellence.

Figure 10. Global Process Manager provides central management of process deployment and governance at the enterprise level. Source: Apriso

FlexNet Global Process Manager streamlines management, control, and change of manufacturing operations to ensure that the right documents and work instructions are at the right place when needed. With Global Process Manager, process ‘models’ can be deployed to individual workstations or throughout the enterprise without recoding or bringing the system down. Best practices developed and refined in one location are easily deployed throughout the company. When configurations across the enterprise need to be updated, Global Process
Manager automatically gathers that information into electronic packages so that it can also manage the deployment to multiple FlexNet systems, simplifying an otherwise tedious and time-consuming task. Making manufacturing process solutions upgradeable, transportable, and supportable long-term requires attention to global deployment just as much as initial design.

Global Process Manager maintains history on “as-designed” and “as-deployed” data, and enables electronic revision control and approval (through electronic digital signatures, as needed) while supporting global deployment of best practices. In addition, the system takes full advantage of FlexNet’s globalization and application integration features to ensure a global process management system that can support internal governance concerns and challenges, such as documenting approval for new process deployments.

Global Performance Manager

Global Performance Manager aggregates events and log data to monitor Key Performance Indicators (KPIs) using graphical management dashboards of charts and alerts. In the BPM world, that is called Business Activity Monitoring, or BAM. While some vendors implement BAM as a standalone technology, it is much more powerful when integrated within a BPM platform. One reason is that performance problems identified by BAM can be traced to a particular step in the process, facilitating rapid resolution. Feedback is available in real time as problems occur. Employees on the shop floor can track their own performance in real time as well. Simply viewing a performance issue won’t allow rapid resolution.

An even bigger reason is that BPM provides the platform for fixing problems identified by BAM. Investigative and corrective workflows can be initiated from the BAM dashboard either manually by a user or automatically by a rule. For example, BPM can reroute work for exception handling, automatically notify customers and suppliers, or take any other user-specified corrective action. In other words, Apriso BPM makes BAM actionable.

Moreover, the results of corrective action can be fed back into revised process designs and rapidly implemented for continuous performance improvement.

Integrating BAM with BPM, however, requires the BAM tool to support BPM values such as an intuitive business-oriented user interface and the flexibility to vary metric definitions by work center and product. BPM provides the framework for capturing application and machine events and a graphical process context for them, but BAM needs to be able to correlate those events for use in calculating metrics, filter and aggregate them in metrics and KPIs, link them in drilldown views, analyze historical trends, and manage the actions triggered when KPIs drift out of their target range.
ApriSo’s FlexNet Global Performance Manager provides this kind of BPM-enabled BAM, and extends it to the global enterprise level. That means KPIs from all regions can be seen side by side in near real time, all calculated in the same way and tracked against target standards (Figure 11). It allows BAM to be used enterprise-wide as part of a corporate manufacturing excellence program, rather than just a standalone plant-based initiative.

FlexNet Global Performance Manager leverages FlexNet platform components such as the process model and orchestration engine, unified data model, and machine connectivity, and adds global KPI definition and calculation, embedded visualization, and actionable dashboards. The main KPI data source is FlexNet’s unified data for time and labor, production, machine events, warehouse, maintenance, and quality. Dashboards are configurable without coding using point-click business controls (Figure 12) and chart wizards. Any FlexNet input can be mapped to a chart data point or series, and users can make a series actionable – enabling drilldowns or actions from the chart – simply by checking a box.
Figure 12. Dashboard “business controls” are user-configurable without code. Source: Apriso

Actionable dashboards – the ability to execute tasks and processes, such as unplanned maintenance for a machine, directly from BAM – are critical to maintaining optimum performance. Traditional dashboards might tell you a problem exists but offer no help in actually fixing it. Apriso allows remediation actions to be invoked from the dashboard without coding.

Figure 13. KPI grids provide instant feedback, drilldown, and trend analysis. Source: Apriso

Global Performance Manager supports versatile KPI calculation, which may be scheduled or on demand, integrated into any process, and based on many data sources. The resulting scorecards (Figure 13) provide instant feedback, drilldown to detailed data for problem resolution, and trend analysis. Many KPIs may be combined on one grid, and one user may have many grids.

Embedded visualization brings performance management directly to the shop floor. KPIs such as availability, performance, quality, and OEE (Figure 14) can be meshed into day-to-day operations rather than published in after-the-fact reports, allowing management to push “metrics that matter” to operators and engineers.
Aprosi FlexNet OES with BPM vs. Conventional MES

All of these factors set Aprosi apart from its MES competitors.

- **Modeling.** Typical MES is limited to routings and recipes. Aprosi supports end-to-end processes and complete definition from activity flow to data.

- **Functional scope.** Typical MES focuses on production only; other operations functions require separate tools. Aprosi integrates all ISA 95 Production, Quality, Warehouse, Labor, and Maintenance activities within a single tool, and supports cross-functional processes (e.g., production replenishment from warehouse) ignored by competitors.

- **Task user interface.** Typical MES requires SCADA or custom programming of end user screens. Aprosi generates screens automatically from the process model.

- **Machine integration.** Typical MES requires Data Historian or SCADA; Aprosi integrates directly with online machine data, barcode and RFID.

- **Customization.** Typical MES requires programming, but Aprosi allows customization without code.

- **Shared design environment.** Typical MES uses a modeling tool for process engineers and a separate programming tool for IT. Aprosi provides a single design environment shared by process engineers and IT.

- **Unified process lifecycle management.** Typical MES does not integrate design with testing and deployment; Aprosi does.

- **Global configuration management.** Typical MES supports versioning, but typically only local configuration. Aprosi supports the centralized global management of process configuration, versioning and deployment, enabling the effective governance of global business processes.

BPM gives Aprosi a level of flexibility, agility, and user empowerment missing in conventional MES. You then might ask why not build a complete custom solution using a
BPM Suite, or why not BPM-enable your MES, quality, and surrounding execution applications using such a suite? The answer to the first is that general-purpose BPM tools are not manufacturing-aware. You would have to build the functionality of a complete MES on top of the BPM layer, and then adapt the terminology used by BPM to the language of operations execution. In contrast, Apriso has a portfolio of 140 pre-defined and documented flows and 410 SOA business components supporting operations execution, BAM, and integration with shop floor machinery absent in any general-purpose BPM solution.

The answer to the second is that your MES and surrounding applications were not designed as services that could be easily composed in a third party tool. And even if they could, they would all have different data models, different programming models, differing terminology and task user interface specifications, etc. That translates into disparate upgrade paths, release calendars, and strategies – all requiring re-integration. If you want a BPM-enabled operations execution solution, your easiest path to that goal is surely to buy one that is already engineered to do that job.

The Bottom Line

Innovation, efficiency, compliance, agility, and end-to-end performance visibility – not to mention cost savings, IT simplification and reuse, and shared best practices…. These proven benefits of BPM in the office environment are needed just as badly in manufacturing operations. Production requirements are diverse and continually changing, so configuration of manufacturing processes needs to be quick and easy to change. True BPM provides that.

A gility and innovation are improved when business and IT collaborate based on a common view of the solution. True BPM is business-empowering, with a single process model shared by process modelers and developers.

Compliance and standardization demand execution flows based on rules, with audit trails and KPI monitoring. True BPM provides this, without losing the ability to adapt on the fly.

Optimizing cost and performance requires managing the process end-to-end, including integration with ERP and PLM. True BPM provides a unified integration platform, instrumented with BAM for end-to-end monitoring and real-time remediation.

In manufacturing execution, end-to-end processes are more than routings and recipes, and BPM means more than just modeling. It means execution of the model and monitoring performance end-to-end. Apriso has taken the true meaning of BPM and embedded it in a full-featured OES solution. If you’re trying to bring more agility, flexibility, compliance, and transparency to your manufacturing operations, take a look at Apriso FlexNet.

Bruce Silver

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